NPP Calibration/Validation Program

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Outline

- NPP Cal/Val Program Approach
- NPP Cal/Val Team and their Roles and Responsibilities
- Cal/Val Peer Review Readout
- Summary

NPP Cal/Val Program is Driven by 2 Main Objectives

- **Accomplish the NPOESS Mission of providing environmental and climatic data to meet civilian requirements and military missions.**
  - Ensure Product Operational Viability.
    - > Provide the NPOESS Customers with validated, useful data products for their applications.
    - > Provide investigations into product defects and inconsistencies of specific impact to Customers.
  - Provide Independent Verification of NGST results.
    - > Provide technical insight and oversight of NGST implementation of algorithm.
    - > Provide scientific validation of products.
    - > Coordinate issue resolution to meet Program priorities.

- **Facilitate the fullest possible exploitation of the unique data provided from NPP/NPOESS by the science, commerce, climate, and academic communities.**
  - Support Data Integration for Mission Systems.
    - > Provide Cal/Val beyond basic contractual compliance required for initiation of use of data product by primary mission systems.
    - > Act as liaison between NGST and operational community to coordinate product updates as required.
  - Support User Community.
    - > Provide general Program information to all users about data products, sensors, and algorithms.
    - > Provide technical support to broad research and development community in their assessment and exploitation of NPOESS data.
    - > Support NASA and NOAA Climate initiatives by sharing data, software tools, and information as needed.

Guiding philosophy developed by Lessons Learned on Heritage Programs

1) Sensor Performance and Characterization are the cornerstone of all data products.
2) Experience and resources from Past Operational and Science Missions should be fully exploited and incorporated in the NPP and NPOESS Programs.
3) Customer and User Satisfaction is achieved through participation in the Cal/Val process.
4) Community Proficiency with Operational Algorithms is essential to efficient Cal/Val and Community buy-in.
5) Space-borne assets, Global models, Surface Networks and Data Assimilation provide a cost effective comprehensive view of sensor and algorithms performances.
6) Targeted Campaigns and Special Studies will be planned and executed as needed.
7) EDR Performance and corrective actions will be handled in accordance with established Program priorities.

IPO and NGST share this philosophy and are working together to develop an executable NPP Cal/Val Program.

NPP Post-Launch Priorities established for efficient Cal/Val Program

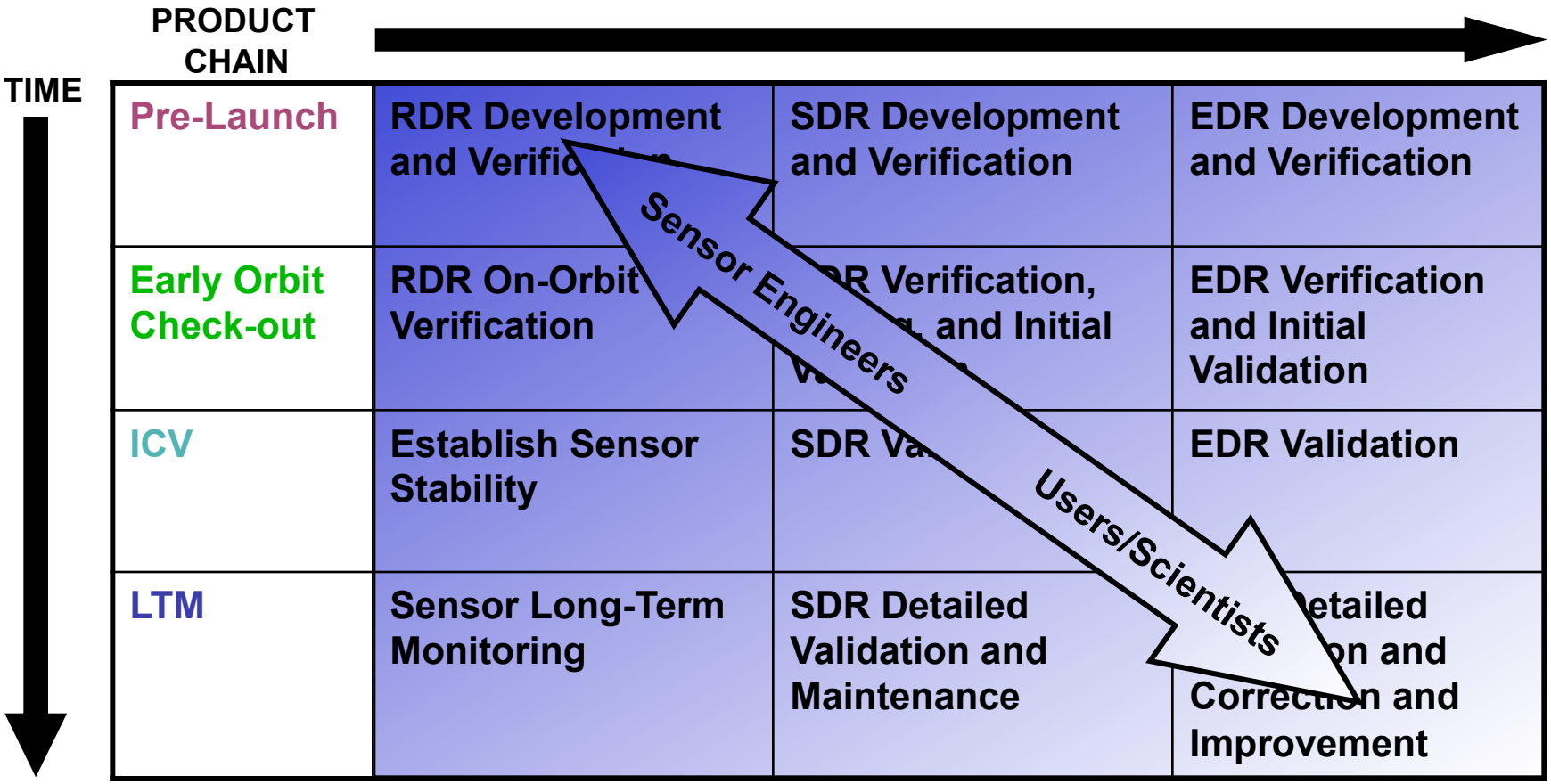
- All Sensors: ***Bullet-proof RDRs*** and archiving every piece of sensor, telemetry, and housekeeping data from spacecraft

- All Sensors: Well tested, ***robust SDRs***.
  - SDRs that reflect reality of as-built sensor, as discovered in pre-launch testing of sensor.

- All Sensors: ***Off-line processing to support SDRs*** (generate coefficients, etc.)

- ***EDRs that characterize sensor on-orbit***, available by no other means:
  - Imagery (Band-to-Band Registration, Noise, Striping)
  - SST (Radiometric Performance of Infrared bands, at the warm end)
  - Cloud Top Temperature (Radiometric Performance of Infrared bands, at the cold end)
  - Cloud Mask (Band-to-Band Registration)
  - Ocean Color (Reflected VIS Performance)

Evolution of Expertise during Cal/Val



Expertise shifts from Contractor Sensor Engineers to Government Customers and Users over time and product chain.

Cal/Val Discipline Leads provide Heritage Experience and Customer Knowledge

- **NPP IPO Cal/Val Product Area Discipline Leads (selected March '08) and their NGST counterparts**
  - ***SDR***
    - > **VIIRS – Frank DeLuccia, Aerospace & Lushalan Liao, NGST**
    - > **CrIS - Gail Bingham, USU/SDL & Denise Hagan, NGST**
    - > **OMPS – Scott Janz, NASA/GSFC & James Done, NGST**
    - > **ATMS – Ed Kim, NASA/GSFC, Bill Blackwell, MIT/LL & Giovanni DiAmici, NGST**
  - ***EDR***
    - > **VIIRS Atmosphere: David Starr, NASA/GSFC**
    - > **VIIRS Land: Jeff Privette, NOAA/NESDIS/NCDC**
    - > **VIIRS Ocean: Bob Arnone, NRL**
    - > **VIIRS Imagery/Cloud Mask: Tom Kopp, Aerospace at AFWA**
    - > **CrIS/ATMS Sounding: Chris Barnet, NOAA/NESDIS/STAR**
    - > **OMPS Ozone: Larry Flynn, NOAA/NESDIS/STAR**
- **Cal/Val Discipline Leads have built teams of SMEs to develop and execute cal/val tasks.**
  - **SMEs from each agency included within each discipline team.**
  - **Teams leveraging resources available form their communities**
  - **Team members identified in Discipline Cal/Val Plans**
  - **Teams hosting regular Discipline Cal/Val Workshops**
- **NDPD and NCDC have begun working on a strategy and implementation plan for NPOESS data stewardship in support of NCDC climate science**
- **NDPD working with JCSDA to develop role for NWP community in NPP Cal/Val**

Cal/Val Discipline Team Members and their roles are detailed in the Discipline Sections of the Cal/Val Plan.

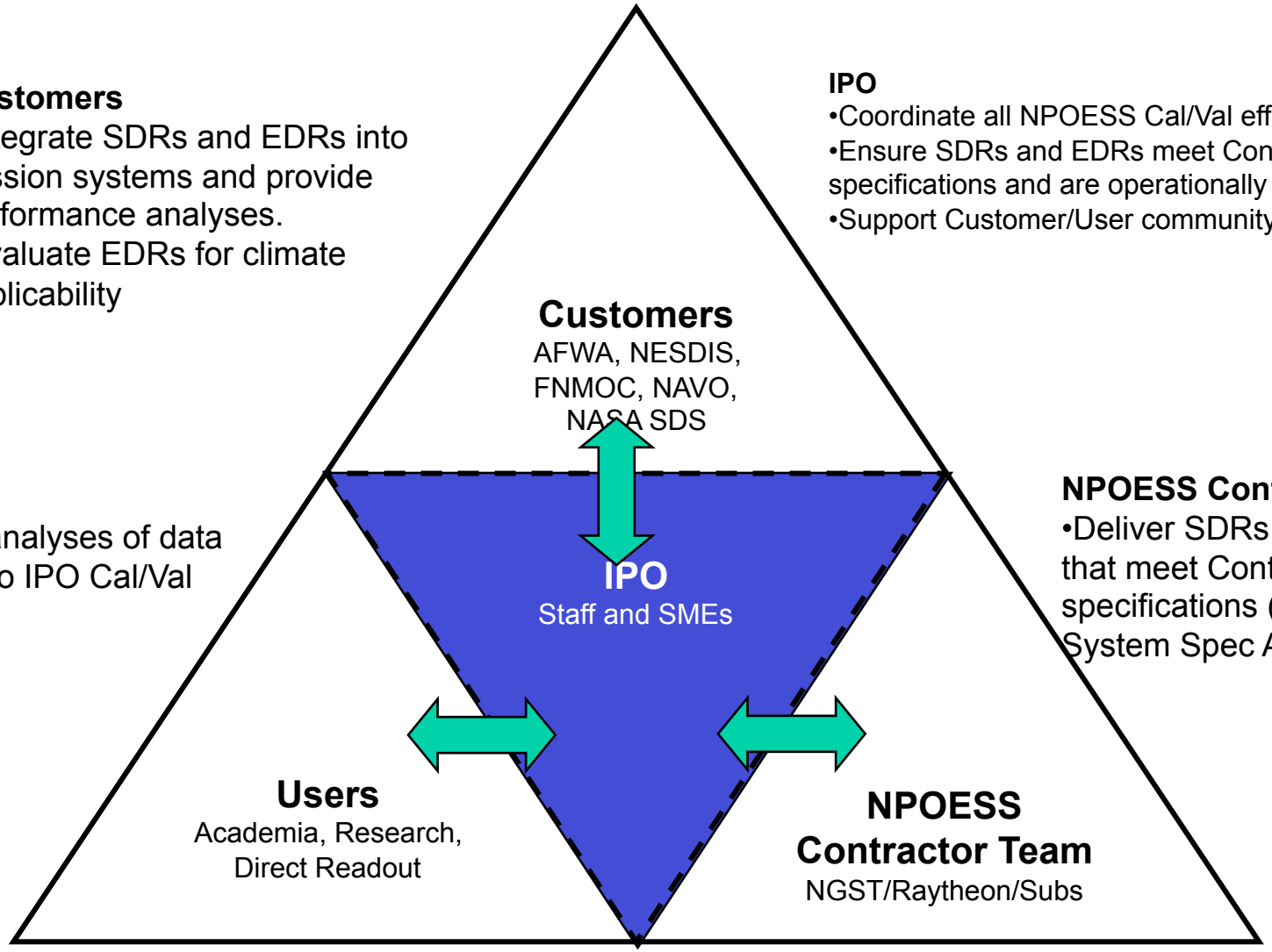
IPO & NGST will Collaborate to achieve Program Success and Contractual Obligation

- **NGST Leads Early Orbit Check-out (EOC) SDR Calibration Effort**
- **IPO Leads the NPOESS Intensive Cal/Val (ICV) Effort**
  - IPO coordinates NPP Cal/Val Team and Operations Team.
  - IPO coordinates tasks outside of NGST with NGST.
  - IPO coordinates anomaly detection functions with Algorithms/xDRs between Customers, Users, IPO, and NGST.
  - IPO presents NGST with Algorithm/Product issues with recommended resolutions, when known.
  - IPO leads development of necessary new science.
- **NGST (A&DP IPT) Leads Algorithm/Product issue resolution integration during the ICV Effort.**
  - NGST responsible for making changes to xDRs to meet specifications.
  - NGST partners with IPO to find problems and solutions.
- **NGST (O&S) Leads the Long-Term Monitoring (LTM) Effort.**

NPP Community has distinct Cal/Val Roles & Responsibilities

Customers
- Integrate SDRs and EDRs into mission systems and provide performance analyses.
- Evaluate EDRs for climate applicability

IPO
- Coordinate all NPOESS Cal/Val efforts
- Ensure SDRs and EDRs meet Contractor specifications and are operationally viable
- Support Customer/User community

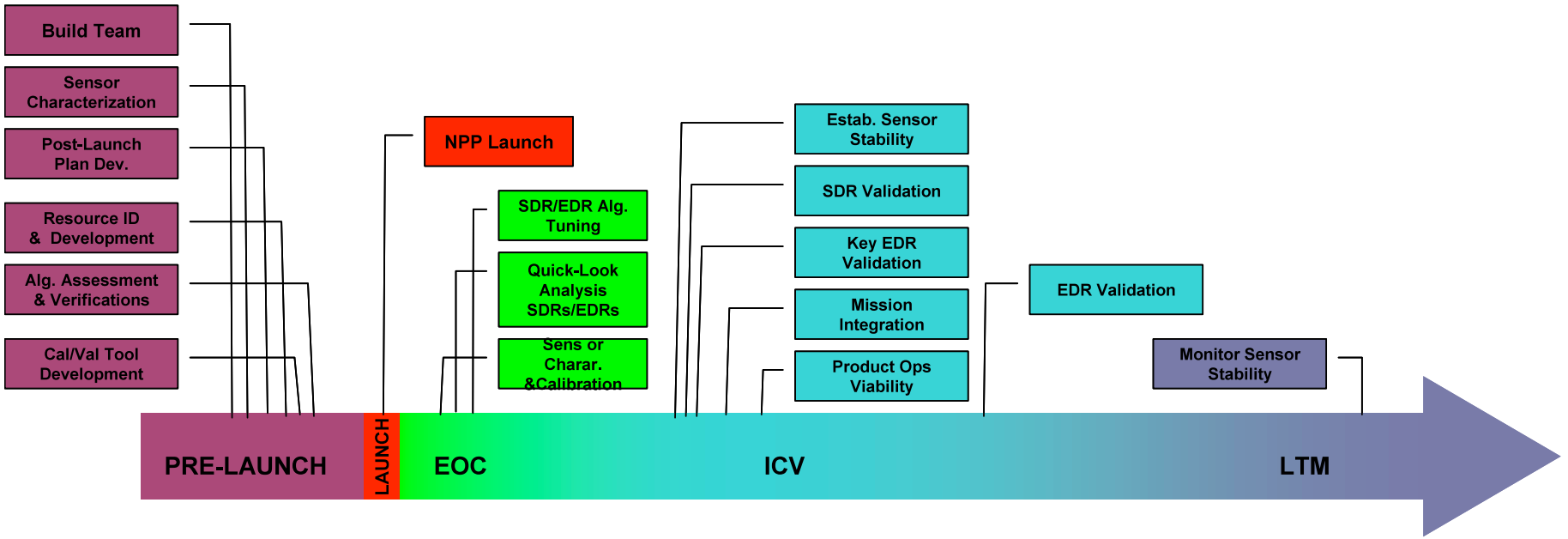


Users
- Provide analyses of data products to IPO Cal/Val Team.

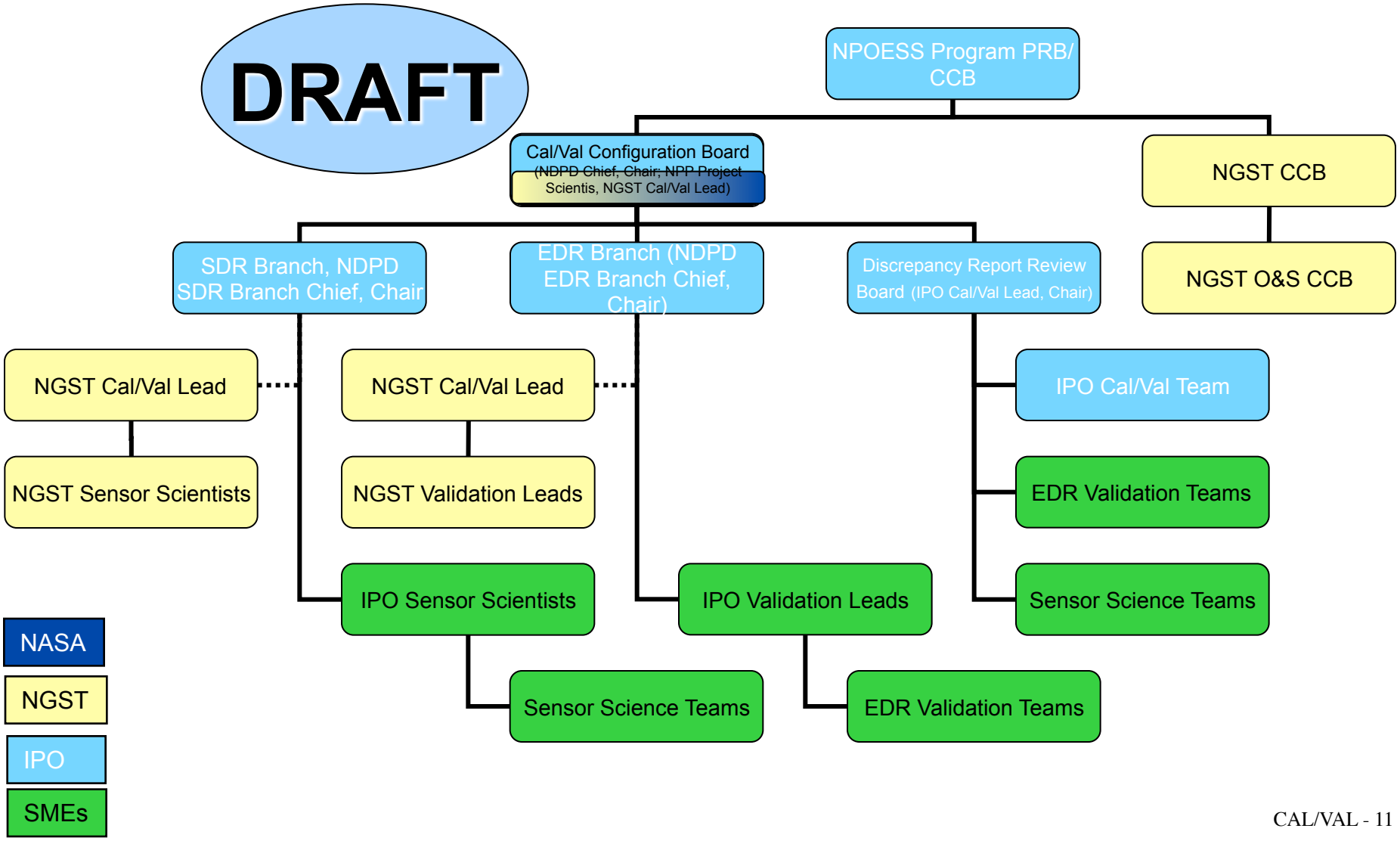
NPOESS Contractor Team
- Deliver SDRs and EDRs that meet Contractual specifications (NPOESS System Spec Appendix D)

Data Products Mature through Cal/Val Phases independently for efficient implementation

- **Four Phases of Cal/Val:**
  1. Pre-Launch; all time prior to launch – Algorithm verification, sensor testing, and validation preparation
  2. Early Orbit Check-out (first 30-90 days) – System Calibration & Characterization
  3. Intensive Cal/Val (ICV); extending to approximately 18 months post-launch – xDR Validation
  4. Long-Term Monitoring (LTM); through life of sensors
- **For each phase:**
  - Exit Criteria established
  - Activities summarized
  - Products mature through phases independently



Cal/Val Management Structure



Cal/Val Peer Review Readout

- **Cal/Val Peer Review held 22 May 2008 at the NOAA Science Center Auditorium in Silvery Spring, MD.**
- **Panel of Cal/Val experts reviewed briefings by the IPO, including the selected Cal/Val Discipline Leads, and NGST detailing the organization of the NPP Cal/Val team and plans to develop the NPP cal/val program.**
  - Panel included Paul Menzel (chair, UW/SSEC), Bojan Bojkov, (UMBC/ GEST & NASA/GSFC), Jeff Morisette (NASA/GSFC), Tom Pagano (NASA/ JPL), Gene Poe (NRL), and Jeff Reid (NRL).
  - Additional guests included interested NPOESS and Customer personnel.
- **Requests for Action (RFAs) were submitted to the Panel for adjudication.**
- **Panel provided report on the peer review and RFAs 1 July 2008.**
  - General feedback from the review was positive, supporting direction of NPP Cal/Val Program and development progress.
  - 27 RFAs assigned with high, medium, and low priority categorizations.
    - > Most were suggestions for cal/val techniques and resources.
    - > Several identify need to collaborate between disciplines and IPO/NGST, which is currently in progress.
- **Presentations located on eRooms at:**
  - NPP Mission eRoom > NPP MOR > NPP MOR > Peer Reviews > Cal/Val Peer Review

Cal/Val Program is progressing on schedule….

- **Accomplish the NPOESS Mission of providing environmental and climatic data to meet civilian requirements and military missions.**
  - Ensure Product Operational Viability through validating data products in a timely manner for Customer use.
  - Provide Independent Verification of NGST results and provide technical insight and prioritization of issue resolution.

- **Facilitate the fullest possible exploitation of the unique data provided from NPP/NPOESS by the science, commerce, climate, and academic communities.**
  - Support Data Integration for Mission Systems by understanding Customer use and application.
  - Support User Community through interaction to resolve issues and providing technical resources.

Back-up Slides

NGST Cal/Val Team
Key Responsibilities

- **All sensors: *Provide Core Sensor Teams* responsible for providing expertise during activation, characterization and anomaly resolution sensors post-launch.**
  - Sensor vendor representatives, payload sensor POC, SDR error budget developer, SDR algorithm developer.
- **All sensors: After ICV, NGST remains responsible for *SDR performance* through the life of the sensor.**
- **All algorithms: During ICV and LTM, NGST is responsible for *integrating changes* to algorithms into the operational processing system efficiently.**
- **All algorithms: During ICV and LTM, NGST is responsible for *resolving problems with algorithms and sensors* causing performance to degrade lower than specified values.**

Integrated Approach will lead to Mission Success

- Contractors will perform integrated Cal/Val approach for all phases with coordination with IPO.
- Giver/Receiver Lists used for providing information between IPTs so each can prepare for their responsibilities.
- Early orbit checkout ensures the sensors are operating within specifications.
- ICV ensures that the SDRs, KPPs, and other EDRs are being produced as required.
- As ICV validates product maturity, products are transitioned to LTM. This is done on a per-product basis.
- During the overlap between ICV and LTM, there will be coordination on Cal/Val processes and “on-the-job” training for the LTM staff.
- Ultimately, a handover will occur between ICV and LTM, but this will be staggered based on when IPO declares products ready for use.

Cal//Val Plan Signature Authority

- Chair, NPOESS PRB/CCB (NPOESS SPD)
- Chair, Cal/Val Configuration Board (Chief, NPOESS Data Products Division)
- Chief, SDR/EDR Branch, NPOESS Data Products Division
- NGST Cal/Val Lead
- IPO Sensor Scientist/Validation Lead
- NGST Discipline Cal/Val Lead

Proposed Cal/Val Plan Approval Process

1. Plans drafted by NGST and IPO Leads with Team input.
2. Plans reviewed by NGST Cal/Val Lead and approved by NPOESS SEIT IPT.
3. Plans approved by SDR/EDR Branch Chief.
4. Plans approved by Cal/Val Configuration Control Board.
    1. Board headed by Chief, NDPD and includes NPP Project Scientist and NGST CV Lead.
    2. NASA SEWG will adjudicate issues before NPP Project Scientist approves
5. Plans boarded by Program CCB/PRB
    1. IPO Payloads, Ground Systems, System Engineering, and Spacecraft Divisions all must adjudicate plans
        1. P/L obtains sensor studies from sensor vendors
        2. SE can only approve with buy-in from SEWG

- Approval of changes varies with impact of change:
    - Contract Change: IPO Program Approval
    - Task Change: Sensor Scientist/EDR Validation Lead Approval
    - Additional changes TBD

Task details being documented and integrated.

- **Execution of Tasks**
  - Cal/val tasks performed by Discipline Teams managed by IPO and NGST Leads.
  - Cal/val tasks performed at facilities as designated in Cal/Val Plan.
    - > Plans developed to leverage existing capabilities/facilities resident with SMEs.
    - > GRAVITE facilitates communication between geographically distributed teams.
  - Tools used to perform cal/lval tasks are described in the Cal/Val Plans.
    - > SMEs may use their own hardware to perform activities, or will be provided hardware by the IPO to facilitate access to GRAVITE.
    - > Necessary tools are being identified, and developed if necessary, in the cal/val planning process.
- **Evaluation of Task Results and Departure from Plan**
  - Adjudication of task issues will be managed at appropriate levels.
    - > Discipline Intra-sensor level managed by Leads with and SDR/EDR Branch Chief
    - > Inter-Instrument level managed by Cal/Val Configuration Board
  - Approval of Product Maturity Status Changes (e.g. Provisional SDR to Validated SDR) granted by Cal/Val Configuration Board based on submitted justification by Discipline cal/val teams.

Approval of IMT and Basis for Departing from Plan (IMT) will be detailed in document being prepared by NPOESS SE.

Cal/Val Team Recommends Changes to IDPS through IPO

DRAFT

Proposed ICV Change Process (e.g. Change to LUT)

1. External community (xOATs, C/V Teams, NASA, Centrals) submit Discrepancy Reports/Change Recommendations to the IPO.

2a: IPO recommends algorithm changes to CV Management Board.
IPO filters and adjudicates change requests from community.

And/Or:

2b: NGST recommends algorithm change to CV Management Board.

3: Joint (IPO, NASA, Centrals, and NGST) Adjudication of algorithm changes.

4: SEIT Verification of Changes.
Initiates, documents, and prototypes changes.
Change is mature before it reaches IDPS Sustainment.

5: Cal Val CCB/ACCB (combined) and O&S CCB approve change.

6: IDPS Sustainment incorporates change into integration baseline for initial evaluation.

7: CCB decides if change is ready to be implemented on Ops baseline.

8: IDPS Sustainment provides update to Ops baseline.

ICV Change Process Goals
Support Quick Integration of "Fixes"

- Baseline control that supports timely updates
- Structured process for IPO and SEITO Cal Val Team to determine algorithm updates and priority
- Cal Val and O&S CCB visibility into sustainment algorithm changes via Work Request
- Progressive integration of changes into IDPS
  - ADA
  - GISF
  - I&T String
  - OPS String
- Process can be adjusted for short turnaround if necessary

IDPS Sustainment Update cycles decrease in time with increase in urgency

Method	Use	Time required
Nominal	Routine updates	Four month release cycle
Compressed nominal	Higher priority changes	Four week release cycle
Urgent updates	IDPS producing unusable data	As soon as possible
Informal integration release	Checkout ICV algorithm changes	One week to I&T string, as little as four weeks to operations

- **Time durations are activities performed by IDPS Sustainment only**
  - **Begins when change request is written and approved**
  - **End when releases delivered to O&S**
  - **Does not include any additional ACCB or O&S CCB review during this window**

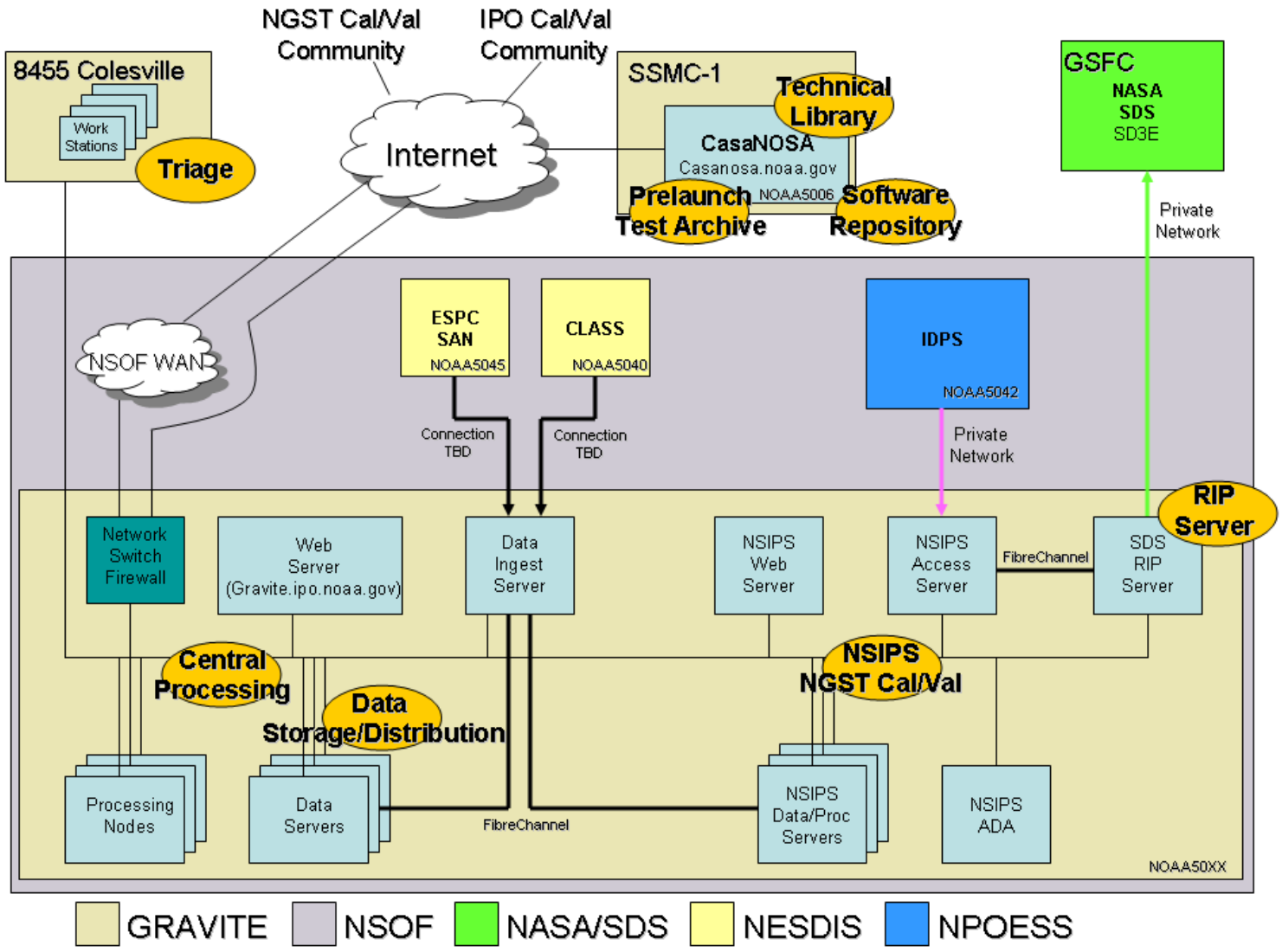
Configuration Control Mechanisms ensure versions are synchronized.

- **CV CCB/ACCB/O&S CCB**
  - Approves all algorithm changes and sets priority
- **Work Requests**
  - Track changes
    - > Proposed (with priority and target release), fixed, verified, and delivered
  - In Factory, WR is mapped to PCR
- **Software CM (Sustainment and MOT)**
  - IDPS source controlled in Rational ClearCase by Sustainment
  - Releases will be sent CM to CM and stored in MOT CM library
  - Releases also sent to CLASS by Sustainment

Tools for performing Cal/Val Activities will be detailed in Cal/Val Plans

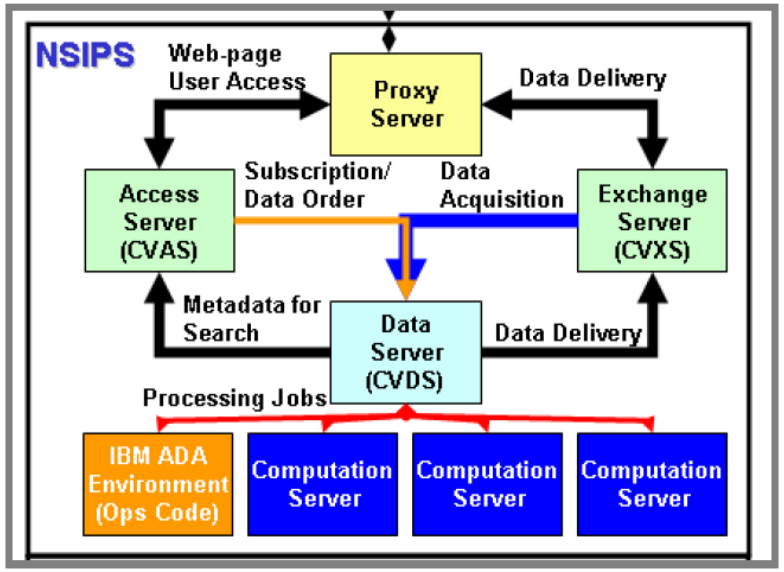
- **GRAVITE**
  - Dedicated support for IPO Cal/Val team
  - Focus is Operational Viability
  - Hosts NSIPS
  - Hosts SDS RIPServer
  - Components
    - > Technical Library
    - > Pre-Launch Data Archive
    - > Processing and Analysis Software Repository
    - > Data Storage and Distribution
    - > Central Processing
    - > Whole System Triage
    - > NSIPS
    - > SDS RIPServer
- **NSIPS**
  - Dedicated support for NGST Cal/Val team
  - Focus is contractual spec
- **NASA Science Data Segment**
  - Focus is evaluation of EDRs for Climate usage

GRAVITE System Diagram



NPOESS Investigator-led Scientific Processing (NSIPS) is developed by NGST

- **NSIPS Prototype System**
  - Linux x86-64 cluster (6 nodes)
  - IBM p570 (4 CPUs, 32 GB RAM)
  - 20 TB RAID
  - Deployed in NSOF 2nd quarter 2007
  - Connectivity
    - > NESDIS IDPS
    - > NASA SDS
    - > NPOESS C3S
    - > CLASS
    - > NCEP
    - > Internet



- **NSIPS Mission System**
  - NSIPS Prototype upgrade to support NPP Mission
  - Linux x86-64 cluster (6 nodes)
  - IBM p570 (16 CPUs, 64 GB RAM)
  - 200 TB RAID
  - System upgrade scheduled 4th quarter of 2009

GRAVITE Documentation available on CasaNOSA

- "Living Documents"
  - Implemented as CasaNOSA wiki's
  - Heavily hyperlinked
    - > Reference information
    - > Actual system features
- GRAVITE Description Document
  - https://casanosa.noaa.gov/docman/wiki_doc.php?id=2427&group_id=263
  - Top level description of the GRAVITE program
- GRAVITE Management Plan
  - https://casanosa.noaa.gov/docman/wiki_doc.php?id=2433&group_id=263
  - Describes processes for execution of the program
- GRAVITE External Interface Control Documents
  - https://casanosa.noaa.gov/docman/wiki_doc.php?id=2428&group_id=263
  - Technical details of external system interfaces